Abstract View

Volume 15, Issue 6 (June 1985)

Journal of Physical Oceanography
Article: pp. 684–694 | Abstract | PDF (927K)

Wind Driven Flow in the Mixed Layer Observed by Drifting Buoys during Autumn–Winter in the Midlatitude North Pacific

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(Manuscript received July 2, 1984, in final form February 15, 1985)

DOI: 10.1175/1520-0485(1985)015<0684:WDFITM>2.0.CO;2

ABSTRACT

Wind-driven flow in the upper 90 meters during autumn–winter in the midlatitude North Pacific is investigated using satellite-traced drifting buoys (i.e., drifters) deployed nearly simultaneously but drogued at different depths. The difference in the relationship between drifter velocity and wind stress as a function of drogue depth is observed to change when its drogue entered the deepening mixed layer. This change is characterized by a sudden increase in the amplitude of the near-inertial motions observed by the drifters and by the onset of a persistent net displacement whose downwind component is approximately 3 times as large as its crosswind component. Attempts to model this downwind flow as a windage result in a large unexplained residual downwind velocity component. On the other hand, 80–90% of the observed crosswind displacement is explained by an Ekman slab model (i.e., with flow uniform over the mixed layer). This large residual downwind velocity component combined with the Ekman driven crosswind component results in drifter displacements whose angle with respect to the forcing wind is significantly greater than 0° and significantly less than 45° to the right (i.e., ~30°).

Details of the flow obtained while the drogues were still below the deepening mixed layer suggests the presence of an Ekman-like spiral in the velocity vector beneath the mixed layer. Subsequent to all the drogues being in the mixed layer, the behaviour of all the drifters with respect to the local wind stress vector was essentially the same (i.e., independent of their drogue depth).

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